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Statement of

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Committee on Aeronautical and Space Sciences
United States Senate

Mr. Chairman and Members of the Committee:

We are pleased to appear before the Committee today in this opening session of the hearings on NASA's FY 1975 authorization request to present and discuss with you the main features of the programs in aeronautics and space we are recommending.

Accompanying me are Dr. George M. Low, Deputy Administrator; Mr. Willis H. Shapley, Associate Deputy Administrator; and Mr. William E. Lilly, the NASA Comptroller. Also present are the principal officials in charge of the NASA programs we will discuss today. These officials will appear individually before the Committee as these hearings proceed to discuss NASA's programs in greater detail.

As shown in the table attached to my statement, NASA's FY 1975 request for authorization and appropriations totals $3.247 billion. This is an increase of slightly more than $200 million over FY 1974 appropriations, but only of about $100 million

over our current budget plan for FY 1974 because FY 1973 funds have financed some of the FY 1974 budget plan.

The FY 1975 budget carries forward NASA's programs generally as planned last year, with the addition of three important new projects in space science and applications -- Pioneer Venus, SEASAT, and a Heat Capacity Mapping Mission (HCMM) -- which I will discuss in a moment. The FY 1975 budget we are recommending will support a productive and balanced program, one which will build upon and continue our past achievements.

In my statement this morning, Mr. Chairman, I would like to say a few words about our major accomplishments and progress during the past year, to report on some problems we have had, and then to review for you the highlights of our FY 1975 authorization request.

Major Accomplishments

First, let me mention some of our accomplishments and progress during the past year.

Three days from now, on February 8 at 11:17 a.m. EDT, the flight phase of the Skylab program is scheduled to come to an end with the splashdown of Skylab 4. Three crews of Skylab astronauts will have traveled over 61 million nautical miles and orbited the earth 2,475 times in a working scientific laboratory -- a giant step toward the routine use of space for science and for practical benefits. Skylab focussed on the sun,

with powerful telescopes providing new data on the sources of the sun's energy; on the earth with experimental observation of resources, storms, and other features, and on man with medical experiments impossible to perform on earth which are confirming, as has the entire Skylab mission, that human beings can live and work effectively in space. Apollo extended man's reach to the moon; Skylab added near-earth space to man's domain.

As Skylab was demonstrating the importance of near-earth space, Pioneer 10 opened a new era of space exploration of the Outer Planets. When it swept past the planet Jupiter on December 3, Pioneer 10 made hundreds of scientific measurements of the giant planet, its inner moons, and its mysterious Red Spot. We have found that Jupiter has a magnetic field 20 times as strong as the earth's; a powerful, strangely configured radiation belt; the surprising presence of helium and many other new features of the largest planet in our solar system and its moons. Pioneer 10 was the first spacecraft to fly beyond the orbit of Mars, the first to penetrate the Asteroid Belt, and will be the first man-made object ultimately to escape the solar system.

1973 will also be marked as the year the earth resources survey program came of age. After its first full year of operation, the Earth Resources Technology Satellite ERTS-1 has acquired and relayed to earth over 100,000 multi-spectral scenes of our planet - more than a billion square miles of

coverage. We have provided over a million copies of these images to Federal and State agencies, resource managers, and investigators here and abroad. The operational values of remote sensing from space are rapidly becoming apparent across a wide spectrum of needs. Some examples of current uses are: rapid and accurate measurement and assessment of major floods, like the Mississippi floods last year; snow and water resource management; new geological exploration and mapping important in mineral and petroleum prospecting; first time surveys of less developed areas; better management of range, forest, agricultural, and urban lands; rapid environmental surveys of dams, ponds, and strip mines; and lake and waterway pollution monitoring. ERTS-1 is being used routinely as a data relay system for hydrological and seismic measurements. Its imagery is being used to update maps, measure crop acreage, find ice-free sea passages, and monitor coastline changes. Experimenters and users alike are learning how to integrate this new data source into operational management and commercial decision processes. The full benefits of even ERTS-1 have not yet been tallied, but a current study underway by the Department of Interior is showing that very significant returns above cost can be expected from a continuing earth resource survey satellite program.

Another major milestone in 1973 was the consumation, last September, of our agreement with nine European nations on the Spacelab, under which the Europeans will develop, at their expense, the laboratory module to be used with the Space Shuttle.

This agreement marks a new high level in international cooperation and in international cost-sharing in the US space program, and will provide a key piece of equipment for realizing the full utility of the Space Shuttle.

During the past year we also made significant progress in other programs. Some examples:

Space Shuttle design and development is proceeding well. All major prime hardware contractors have been selected. We now have completed and published our comprehensive analysis of the number and kinds of payloads we could launch with the Shuttle during its first 12 years of operations. The analysis confirms the preliminary estimates we discussed during the Committee's October 30, 1973, hearing: that we can expect savings resulting from the use of the Shuttle of over $1 billion a year during that 12-year period. You may wish to include in the record of these hearings portions of the final report of our economic analyses which we sent to the Committee last week.

In aeronautics we continued to attack problems of aircraft noise and pollution and our efforts to enhance safety and improve aircraft fuel economy. For example, during 1973 in in-flight tests of the NASA "supercritical wing," the F-8 test aircraft used 15% less fuel during high speed cruise than the same aircraft with a conventional wing. Preliminary data from recent F-111 flight tests tend to confirm these results. With this and other technological advances in NASA's programs we estimate that a total potential fuel savings of 30% in the operation of civil transport aircraft is possible. Substantial progress has also been made in the JT8D engine refan noise reduction program. We are now at a point where we will begin ground testing of this engine modified with NASA-developed technology.

Finally, let me note that technological benefits of NASA's programs are continuing to flow into our economy and make useful contributions to important national and human interests. Technology and capabilities developed in the space program are being used, for example, by the oil industry in establishing environmentally safe procedures for outer continental shelf oil drilling, by electric utility companies in developing the use of Apollo-type fuel cells for commercial power generation, and by the medical equipment community for developing new types of medical analysis and patient monitoring equipment. These and other benefits the nation is receiving from NASA's space and aeronautics programs will be presented in more detail later in these hearings.

Mr. Chairman, we have prepared a more comprehensive statement on last year's highlights, and we would be glad to furnish it for the record if you wish.

Problem Areas

I should report briefly on three problems we have had; two have already been subjects of hearings before the Committee.

First, there was the problem of the near catastrophic damage to Skylab when the micrometeorite shield broke away carrying with it one of the solar panels and leaving the Skylab without sufficient insulation from the sun's heat. As you all know, the damage was repaired in a dramatic effort by the astronauts and the mission has been an outstanding success from that time.

Second, we have had problems in our Equal Employment Opportunity program which were discussed at the Committee's hearings on October 30, 1973, and January 24, 1974. We are frank to say that NASA has not done as well as it should in this area, and have set ourselves more ambitious goals and timetables for the coming year. With NASA's civil service employment now stablized, with no further cross-the-board reductions in force, I believe these goals are attainable and will be met.

Third, we are experiencing technical developmental difficulties in the Viking program with some of the exceedingly complex equipment required for landing and conducting automated scientific experiments on the surface of Mars. Because of these difficulties

we have had to accept the necessity of an overrun of 5% - 7% in the projected total cost of $838 million we estimated for Viking research and development 4 years ago. We are working hard with our contractors to solve the technical problems and to minimize the extent of the overrun. We will shortly be submitting to the Congress a reprogramming action covering the adjustments in our budget plan we are making in FY 1974. The further adjustments required in our FY 1975 budget will depend on progress in resolving the technical problems and the effectiveness of efforts by NASA and our contractors to control costs. Dr. Naugle will discuss the problems with Viking in detail when he appears before the Committee.

The FY 1975 Budget

Let me now turn to the main features of our FY 1975 authorization request.

First, let me say a few words about the NASA budget totals. You will recall that NASA's FY 1974 budget reflected a sharp temporary reduction, because of Government-wide fiscal problems at that time, below the $3.4 billion level previously planned as the long-term NASA budget level and approved by Congress for FY 1973. Last year, the need was clearly recognized for increases in the NASA budget in FY 1975 and subsequent years in order to approach again the level required to maintain a balanced program of continuing advances in space and aeronautics for the rest of the decade.

The FY 1975 budget does provide an increase for NASA, as I have indicated, but because of the financial constraints within which the President's overall FY 1975 budget has been prepared, the increase provided is less than would have been required to maintain NASA's entire program as planned last year, after taking account of the effects of inflation and other necessary adjustments.

We have been obliged, therefore, to make some program adjustments, the principal one being in the development schedule for the Space Shuttle. Under this and predicted future budgets, the first manned orbital flight of the Shuttle is now expected to occur in the second quarter of 1979 instead of at the end of 1978, a change of from 4 to 6 months. A firm schedule is extremely important in a large-scale complex development program like the Space Shuttle. We believe that the increases in projected future total NASA funding levels now agreed to for FY 1976 and reflected in the FY 1976 projections in the President's FY 1975 budget, and the increases projected for subsequent years, will enable us to avoid further schedule changes in the Space Shuttle program and at the same time maintain continuity and balance in other NASA programs within the previously planned total NASA budget levels.

Now let me describe the three new space flight projects in our FY 1975 budget.

1. Pioneer Venus - This is a project which has had a top scientific priority as the next step in planetary exploration

and which we have been studying for several years. Detailed study of the composition and global dynamics of the atmosphere of Venus, 100 times more dense than the earth's will give us a better understanding both of that planet and of the forces that drive the earth's atmosphere, meteorology, and climatology. Two Atlas-Centaur launched missions will fly to Venus in 1978. One will send entry probes into four locations in the Venus atmosphere to measure the composition and global dynamics of that atmosphere. The other will place a spacecraft in orbit about the planet to study the characteristics of the atmosphere and their temporal changes.

Incidentally, our Mariner 10 spacecraft, launched on November 3, 1973, is approaching Venus at this very moment and will pass within 3,600 miles of that planet later today, on its way to Mercury. The data on Venus it will send back, together with what we have learned from Mariner 2 in 1972 and Mariner 5 in 1967, the Soviet Venus missions, and ground based observations, provide the necessary scientific base for the comprehensive experiments of Pioneer Venus.

2. SEASAT will be a specialized experimental applications satellite to observe and measure the oceans, both to develop a scientific understanding of ocean dynamics and to determine the feasibility of developing an ocean dynamics forecasting system which could be of great economic value to the shipping and fishing industries, for example, and to others concerned with maritime matters. SEASAT-A will be launched in 1978 to

monitor the world's oceans by measuring sea state, wave height, wind speed, ocean temperatures, and other characteristics. This will provide data for user applications including ship routing, ship design, storm damage avoidance, coastal protection and development, and deep water port development. In this program we are working closely with the other Government agencies directly concerned with the oceans--the National Oceanographic and Atmospheric Administration (NOAA), the Coast Guard, and the Navy.

3. Heat Capacity Mapping Mission (HCMM) - This will be another specialized experimental applications project. It will use a small "Explorer-type" satellite to make thermal measurements of the earth's surface. These measurements will be used to identify favorable locations for further ground investigations which will determine our ability to discriminate rock types and rock structures on a regional basis. This discrimination can be of major value in locating targets for the further exploration of mineral resources and in the planning of the construction of major civil works such as highways and canals. The measurements will also be used to investigate further the feasibility of locating geothermal sources by remote mapping from a spacecraft. These sources, in the forms of hot gases, liquids or rocks, can potentially contribute to our nation's energy requirements. The HCMM will be launched on a Scout launch vehicle in 1977. The Department of Interior is working with us on this project.

Let me also mention another new item of interest in our FY 1975 program. We plan to build an infrared telescope facility

to be used primarily for planetary research to provide supporting and complementary data to our planetary exploration and astronomical missions. It is important that we have this additional source of data on Jupiter and Saturn and their moons prior to the launch of the Mariner Jupiter/Saturn mission in 1977. The infrared telescope will be built on Mauna Kea, Hawaii.

On the institutional side, NASA's civil service employment will be stabilized at the end of FY 1974 levels except for a further reduction of about 350 at the Marshall Space Flight Center at Huntsville, Alabama, related to the completion of the Skylab program. Stabilization of our civil service employment will be extremely beneficial to NASA. It will permit us to take advantage of normal turnover to employ more young people on whom the vitality of NASA depends and, especially important, give us a better opportunity to increase the employment of members of minority groups and women in NASA.

Let me now review briefly some of NASA's principal on-going programs which will continue in FY 1975:

- Scientific analysis of the invaluable Apollo lunar samples and other data from the Apollo missions will continue and further develop our understanding the evolution of the moon and its relations to the earth. Five science stations that were placed on the moon by the Apollo astronauts are still in operation.
- As I have mentioned, the flight phase of Skylab will be completed with splashdown of Skylab 4 on February 8. Analysis of the solar, earth resources, medical and other scientific data will continue for many years.
- The Apollo-Soyuz Test Project (ASTP) is going forward smoothly, with joint engineering and training activities with the Soviets taking place on schedule. There have

been eleven major technical interchange meetings. Joint US-USSR communications compatibility tests are currently underway in Houston.

- The Space Shuttle development program will be moving into high gear in the fabrication and testing phases. The first two orbiters and many of the test articles of key components will be in fabrication, and the main engine will begin actual testing at the Mississippi Test Facility. Detail design and initial fabrication of the external tank and the solid rocket motor will also begin.
- On the space tug or orbit-to-orbit stage (OSS) to be used with the Shuttle, we have a tentative agreement with the Department of Defense that they will plan to modify an existing upper stage for use with the Shuttle during the initial period when the Air Force and NASA will make the transition from expendable launch vehicles to the Shuttle. NASA will continue planning for later development of a space tug which will be capable of satellite recovery, including recovery from synchronous orbit, and could be available in the middle 1980's.
- In aeronautics we will continue a broad variety of programs to develop and demonstrate technology for both civil and military aviation. On the civil side we will continue to emphasize technology which can improve the fuel economy, reduce the noise, and improve the performance of US-built civil transport aircraft, thereby helping maintain the US competitive

position in an area that is vitally important to our balance of trade position.

- In space applications, the earth resources satellite ERTS-1 is still working well, even though it has now exceeded its design life by over six months. We have accelerated the launch of ERTS-B, as recommended by the Congress last year. We now plan to launch ERTS-B, the second earth resources satellite, no later than about a year from now, instead of in 1976. The exact date will depend on how long ERTS-1 lasts, the technical needs of the ERTS-B experiments and users, and the readiness of the ERTS-B experimenters. Other highlights of the space applications program include the first synchronous meteorological satellites (SMS-A and B, and GOES-A) which will be launched later this year, as will NIMBUS F, with special instrumentation for continuous day/night weather surveillance. The TIROS-N program to develop the prototype of the next generation of NOAA's operational meteorological satellites is proceeding and will effect economies by making maximum use of spacecraft and instruments developed in other programs. The ATS-F experimental communications satellite will be launched this spring after many years of development and begin an extensive series of educational and other user-oriented experiments. These projects, the other applications projects which will be discussed in detail during the course of these

hearings, and the new starts I discussed earlier attest to the fact that the space program is now very clearly oriented to practical applications in a wide variety of fields.

- In space astronomy, the Orbiting Astronomical Observatory "Copernicus" (OAO-3) continues in its second year of useful operation, together with several smaller observatory satellites now in orbit. Development of the Orbiting Solar Observatory (OSO-I) continues for launch in 1975, and development of the High Energy Astronomy Observatory (HEAO) series of satellites will be resumed after its suspension last year; launches are now planned in 1977, 1978, and 1979. We are continuing the preliminary design work on the Large Space Telescope.
- The field of planetary exploration is especially active and exciting. Pioneer 10 is still going strong and sending back data after collecting a wealth of measurements as it passed Jupiter last December. It is now about 560 million miles from earth, travelling at 50,000 miles per hour, and in about five years will leave the solar system. Pioneer 11 is on its way and will give us our second good look at Jupiter in December 1974. As I mentioned, Mariner 10 will fly past and observe Venus at close range today and will be the first spacecraft to observe the smallest

planet, Mercury at close range late in March. During the same period the four Russian spacecraft launched last May will arrive at Mars, on orbiting and landing missions. Viking, our program for landing an automated scientific laboratory on Mars, is in the crucial phases of its development, as I have mentioned, but we expect that this extremely complex spacecraft will be ready for launch in the fall of 1975 and landing on Mars in July 1976. Finally, the Mariner Jupiter/Saturn program will enter its third year of development; the launches are scheduled for 1977.

Mr. Chairman, even within the constrained budgets NASA has had in recent years and has again in FY 1975, we believe that we can carry out a hard-hitting, useful, and exciting program in space and aeronautics, one that deserves the support of the Congress and the nation.

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National Aeronautics and Space Administration

FY 1975 AUTHORIZATION REQUEST
(In Thousands of Dollars)

	FY 1973	FY 1974	FY 1975
Research and Development			
Space shuttle	198,575	475,000	800,000
Space flight operations	879,000	580,000	323,300
Advanced missions	1,500	1,500	1,500
Apollo	56,700	---	---
Physics and astronomy	126,200	94,000	140,515
Lunar and planetary exploration	331,969	333,000	266,000
Launch vehicle procurement	221,000	175,000	140,500
Space applications	188,700	161,000	177,500
Aeronautical research and technology	150,640	168,000	166,400
Space and nuclear research and technology	81,860	69,000	74,800
Tracking and data acquisition	248,331	244,000	250,000
Technology utilization	4,000	4,500	5,500
Subtotal, Research and Development	2,488,475	2,305,000	2,346,015
Construction of Facilities	78,725	101,100	151,490
Research and Program Management	721,783	744,786*	749,624
Subtotal, Budget Plan	3,288,983	3,150,886	3,247,129
FY 1973 funds applied to FY 1974 budget plan	111,000	-111,000	---
Unobligated balances lapsing and other adjustments	7,667	---	---
Total Appropriations (FY 1973 and FY 1974) and FY 1975 Authorization Request	3,407,650	3,039,886*	3,247,129

*Includes $37,786,000 proposed supplemental for civilian pay raises.